IN THE SPECIFICATION:

Page 1, before line 5, the paragraph beginning "the invention", insert the following headings and paragraphs:

--**CROSS REFERENCE TO RELATED APPLICATIONS**

This is a division of U.S. Patent Application Serial No. 09/743,165 filed January 5, 2001, 2001, the specification of which is incorporated herein by reference.

PRIORITY CLAIM

This is a national stage of PCT application No. PCT/FI99/00604, filed on July 7, 1999. Priority is claimed on that application and on patent application No. 981574 filed in Finland on July 8, 1998.

FIELD OF THE INVENTION--.

Page 1, lines 5 to 14, amend the two paragraphs as follows:

--The invention relates to method ~~according to the preamble of claim 1~~ for manufacturing coated paper, board or similar product having a plant fiber base, in which method a layer of coating furnish is applied and adhered to a base web made of the fibers. The coating furnish at least partially consists of a carbonate compound.

The invention also relates to an ~~assembly~~ apparatus suitable for implementing said method and a plant-fiber-based product coated with said carbonate-based coating furnish.

The invention also relates to the use of recycled calcium carbonate in the treatment of a paper, board or nonwoven product.--

Page 1, before line 16, the paragraph beginning "In the", insert the title:

--**BACKGROUND OF THE INVENTION**--.

Page 1, lines 16 to 18, amend the paragraph as follows:

--In the context of the present application, the term ~~paper~~ "paper" is used when reference is made to any product produced on a plant fiber base such as a web of paper or board.--

Page 2, before line 3, the paragraph beginning "It is", insert the title:

--SUMMARY OF THE INVENTION--.

Page 2, lines 14 to 24, amend the three paragraphs as follows:

-- More specifically, the method according to the invention ~~is characterized by what is stated in the characterizing part of claim 1~~ comprises forming a web from fibers, and treating the web with pigment particles having an average size in the range of 0.5 - 100 nm, most advantageously 15 - 25 nm.

The invention also relates to a use of recycled calcium carbonate in the treatment of a paper, board or nonwoven product, in which the calcium carbonate is prepared by calcining the precipitated calcium carbonate residue of the deinking process of recycled fiber into lime. The lime is reacted with water into calcium hydroxide, and the calcium hydroxide thus formed is reacted with carbon dioxide into calcium carbonate so that particles are formed having an average particle size so small as to permit the particles to adhere to each other by van der Waals forces.

Further, the ~~assembly~~ apparatus according to the invention ~~is characterized by what is stated in the characterizing part of claim 38~~ comprises means for supporting a web being formed, and means for forming calcium carbonate at least on the surface of the web. The means for forming calcium carbonate comprises at least means for feeding calcium hydroxide into contact with the surface of the web, and a chamber via which the web is adapted to travel and into which chamber is passed carbon dioxide containing gas in order to react carbon dioxide with calcium hydroxide so as to form calcium carbonate.

Still further, the paper web product according to the invention ~~is characterized by what is stated in the characterizing part of claim 55~~ comprises a fiber layer containing cellulosic fiber, plant fiber or other material suitable for manufacturing a paper, board or nonwoven product, in which at least one surface of the fiber layer is treated with elementary pigment particles of size in the range of 0.5 - 100 nm, most advantageously 15 - 25 nm.--.

Page 2, line 28 to page 3, line 11, amend the paragraph as follows:

--By virtue of the invention, a web can be coated without using any water in the coating furnish, whereby also the web need not be dried during any step of the coating process and no equipment is required for preparing an aqueous coating mix. The overall length of the coater can be made shorter and its construction may be simplified. Because a major fraction of the energy consumed at the coater is used for drying the aqueous coating suspension, the invention offers significant savings in the specific energy consumption of coated paper grades. The invention may be combined with a dry base web-formation method (cf. ~~FI Pat. Appl.~~ Finnish Patent Application No. 973775 ~~filed by the applicant~~), thus permitting the entire papermaking process to be carried out without any drying steps or, alternatively, using a minimal amount of water and drying. During web formation, calcium carbonate or its precursors can be fed into the fiber mass, whereby also the filler is introduced into the web. As known, calcium carbonate particles or the formation thereof in the web improves the interfiber bonding, whereby the web becomes stronger than a web containing no fillers.--.

Page 3, before line 37, the paragraph beginning "In the", insert the following new paragraph and title:

--Other objects and features of the present invention will become apparent from the following detailed description considered in conjunction with the accompanying drawings. It is to be understood, however, that the drawings are intended solely for purposes of illustration and not as a definition of the limits of the invention, for which reference should be made to the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS--.

Page 3, line 37 to page 4, line 2, amend the paragraph as follows:

--In the following, the invention will be examined in greater detail with the help of exemplifying embodiments illustrated in the appended drawings in which like reference numerals delineate similar elements throughout the several views:--.

Page 4, before line 28, the paragraph beginning "Int. Pat.", insert the title:

--**DETAILED DESCRIPTION OF THE PRESENTLY PREFERRED EMBODIMENTS**--.

Page 4, line 28 to page 6, line 10, amend the two paragraphs as follows:

--~~Int. Pat.~~ PCT Patent publication No. WO/96/237228 and ~~FI Pat. Appl.~~ Finnish Patent Application No. 964,365 describe a method for preparing extremely small and homogeneously sized PCC (Precipitated Calcium Carbonate) particles. In this method, PCC particles are formed from slaked lime CaO with the help of water and carbon dioxide in a direct gas-phase reaction, whereby extremely small particles are created with a diameter smaller than 100 nm, or even smaller than 20 nm. There is also described a method for coating particles of natural calcium carbonate with precipitated carbonate. Under suitable conditions, the prepared elementary particles floc into roundish aggregate particles of a cloudberry shape that have better rheological and optical properties than conventional PCC particles of needle-like shape. The size distribution of the flocced aggregate particles is very narrow and the flocced particles made using this technique are almost invariably smaller than 500 nm. The particles forming the aggregates are bonded to each other by van der Waals and capillary forces that become effective when the particles are disposed from each other at a distance smaller than 100 nm. On the other hand, the zeta-potential that characterizes the potential difference of the particle's ion field to the medium tends to separate the particles from agglomerating with each other. As the zeta-potential is strongly dependent on the pH of the particle, the formation and size of the aggregate particles can be affected by varying the degree of turbulence, or average mutual distance, and pH of the particles tending to aggregate together. If the degree of turbulence in the particle flow is sufficiently high, the elementary particles can be kept apart from each other. A more detailed description is given in the cited patent applications.

In the most advantageous embodiment of the invention, the use of PCC made using the novel technique is combined with application to a web by means of ion-blasting. Thus, when PCC is transferred, e.g., by ion-blasting to the web surface, the particles are bonded directly to each other and the web surface by van der Waals and other forces even without using any additional binder. ~~Resultingly~~ As a result, the web is coated with a homogeneous and hiding layer of carbonate particles that has the same toughness as the single carbonate aggregates even though it smoothly covers the entire web of fibers. Coat application may also be accomplished using a gas flow, whereby a flow is directed tangential to the web surface and performs so as to

smooth away the irregularities of the web surface when the particulate matter coating accumulates in the depressed points of the web in the same manner as drifting snow. The carbonate particles may also be impinged with a high velocity perpendicular to the web, whereby the carbonate particles ~~are penetrated~~ penetrate into the interstatial spaces between the web fibers thus introducing a filler into the base web. By virtue of this technique, the web-formation section of a paper machine can be constructed without a filler feed system.--.

Page 6, line 35 to page 7, line 5, amend the paragraph as follows:

--An important feature of the invention is the possibility of recycling the calcium carbonate of deinked waste paper by feeding the precipitated calcium carbonate of the deinking process to a calcination plant. The calcium oxide obtained from the calcination plant can be treated into precipitated calcium carbonate that may then be used in the manner described in the cited publications and the present application.--.

Page 8, line 9 to page 9, line 27, amend the two paragraphs as follows:

--In Fig. 1 is shown one embodiment of the invention. The calcium carbonate particles are here formed directly in a gas phase in a chamber 1 as described in above-cited patent applications and are taken therefrom via a tube 2 into a particle circulation path 3 formed by a circular tube. In the particle circulation, there is maintained a continuous flow (denoted by arrow 4) serving to keep the particles in a continuous motion and preventing their floccing into excessive large aggregates. Additionally, floccing can be controlled by altering the pH of the particulate matter fed into the circulation, whereby the zeta-potential of the particles is lowered and the floccing tendency is reduced. Correspondingly, the aggregate size can be increased by elevating the pH level of the particles. The particle circulation tube 3 is passed to an ion-blast zone 6 formed into a chamber 21. ~~Via~~ Through the chamber 21 is also passed a paper or board web 11 to be coated, as well as a conducting wire 15 supporting the same. In Fig. 1, the web is shown travelling from the left to the right. The wire 15 passes over guide rolls 12, 13, 14 so as to form an endless loop. The wire 15 is grounded or taken to a low potential via a connection 16 made to a guide roll 14, for instance.

~~To~~ In the interior of the ion-blast chamber 21 and directed toward the web 11 and the wire 15, there are ~~adapted~~ a plurality of pointed-tip electrodes 22 connected via a conductor 5 to a power supply 23. From the power supply, a high potential relative to the conducting wire 15 is applied to the electrodes 22, whereby between the electrodes and the wire is created an ion-blast zone 7 of conical flux tubes of the electrical field that directs the particulate matter flow toward the web 11. As the field lines leaving the tip of each pointed electrode 22 form a flux tube of a conical shape, the number and location of electrode tips must be configured so that the conical flux tubes leaving the staggered electrode tips provide a uniform field on the surface of the web 11. The applied electrode voltage is dependent on the distance between the counterelectrode formed by the conducting wire 15 and electrode tips 22 that may be varied from 2 mm to 2 m; however, to keep the space requirements of the coating furnish feed equipment within practicable limits, an interelectrode distance range of 100 - 1000 mm is favoured. While a large inter-electrode distance as such does not impair the function of the apparatus, it increases the external dimensions of the system and complicates the behaved control of material flows in the chamber ~~16~~ 21. When using a design based on the practicably most favourable interelectrode distance range, the voltage applied between the opposed electrodes is typically set in the range 80 - 160 kV, but may be varied as widely as from 30 kV to 1000 kV. The counterelectrode may be run positive or negative, and the electrode tips may respectively be connected to the negative or positive terminal of the power supply.--.

Page 12, lines 2 to 26, amend the paragraph as follows:

--In Fig. 6 is shown a method and apparatus for forming a carbonate coating layer directly from precursors on the surface of the web 11. In this method, the ion-blast chamber 21 with its coating particle circulation and the structure of the conducting support belt are similar to those of the above-described apparatuses. The difference herein is that the particle circulation in the present case is fed with slaked ~~slime~~ lime particles CaO that are transferred to the web surface by ion-blasting. Next, the web is passed into an enclosure 24 where water is applied to the web, e.g., under a steam or mist atmosphere. Alternatively, the water may be introduced as mist or steam in the ion-blast chamber 21 or using any other suitable technique. When the slaked lime CaO reacts with the applied water, calcium hydroxide $Ca(OH)_2$ is formed. Next, the web 11

is passed into a chamber 25 enclosing a carbon dioxide atmosphere partially or purely comprised of carbon dioxide, whereby the calcium hydroxide $Ca(OH)_2$ reacts with the carbon dioxide so as to form calcium carbonate particles on the web surface. The water released in the reaction is discharged from the chamber. When desired, the adherence of the formed particles to the web surface may be secured by ion-blasting, whereby also a blast of carbon dioxide gas can be directed to the web surface.--.

Page 13, line 35 to page 14, line 26, amend the paragraph as follows:

--In its amorphous form, that is, immediately after the carbonization of calcium hydroxide, the applied coating is readily workable. Hence, the nano-size PCC should be calendered or otherwise smoothed immediately after the application. Then, the calendering effect is imposed on the readily workable amorphous, cloudberry-like calcium carbonate aggregates (nano-size PCC). The aggregates are durable under the plastic deformation and can be levelled under the calendering pressure to form a smooth surface. Also the individual aggregates undergo a plastic deformation. ~~Resultingly~~ As a result, a surface with an extremely smooth and level profile is obtained. The levelling of the web surface to a smooth profile immediately after application may be implemented using the following techniques:

a) cold calendering involving mechanical compaction, whereby the fixation of the aggregate particles may also require the use of a specific binding agent if the bonding forces between the fibers of the base web and the coating particles are not sufficiently strong to ensure so strong bonds that the coating material can adhere in a secure manner to the web surface;

b) hot calendering in which the water contained in the aggregate particles is released during hot calendering under the hot calender roll thus improving the formation of hydrogen bonds between the aggregate particles of the coating material (this does not exclude the use of bond-formation-promoting additives) and the paper web, as well as the formation of interparticle bonds. The test results of this latter technique have been positive.--.

Page 17, line 16 to page 18, line 7, amend the paragraph as follows:

--In ~~FI Pat. Appl.~~ Finnish Patent Application No. 973775 is disclosed a method of forming a paper or board web or any other web of basically fibrous structure, in which method a moving web-formation substrate is covered with a raw material furnish comprising cellulosic pulp fiber, plant fiber or other materials suitable for making a paper, board or nonwoven product. The raw material furnish fed onto the web-formation substrate is passed into at least one compression nip for forming a firm web from the laid fibers of the raw material. Next, the web-formation substrate is connected to a first electrical potential and a second potential higher than said first potential is applied displaced from said first potential at a distance above that side of the web-formation substrate on which the raw material furnish is being fed, whereby an electric field is established between said potentials. The voltage between said first potential and said second potential is adjusted so high as to establish a corona discharge in the vicinity of said higher potential, said discharge being capable of causing an ion blast from said higher potential to said lower potential, whereby said ion blast transports the particulate raw material existing in the space between said potentials onto said web-formation substrate and assures the adherence of the raw material to the substrate. In conjunction with the above-described method, the particles of web treatment material can be fed in the web-formation step into the flow of the raw material fibers or, alternatively, directly onto the formed web in a manner described above.--.

Page 18, after line 23 (last line) insert the following new paragraph:

--Thus, while there have been shown and described and pointed out fundamental novel features of the present invention as applied to preferred embodiments thereof, it will be understood that various omissions and substitutions and changes in the form and details of the devices illustrated, and in their operation, may be made by those skilled in the art without departing from the spirit of the present invention. For example, it is expressly intended that all combinations of those elements and/or method steps which perform substantially the same function in substantially the same way to achieve the same results are within the scope of the invention. Substitutions of elements from one described embodiment to another are also fully intended and contemplated. It is also to be understood that the drawings are not necessarily drawn to scale but that they are merely conceptual in nature. It is the intention, therefore, to be limited only as indicated by the scope of the claims appended hereto.--.